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Gone with the wind: Homoptera Auchenorrhyncha collected by the French network of suction traps in 1994

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Running title : Auchenorrhyncha collected by the suction traps in France.

Key words: Auchenorrhyncha, suction trap, zoogeography, fluctuation population, migratory flight, dispersal.

SUMMARY

Out of 10,790 specimens comprising 137 species of Auchenorrhyncha caught by the French Agraphid network in 1994, were identified. They belong to 4 families: Cixiidae, Delphacidae, Cercopidae and Cicadellidae. Delphacidae and Cicadellidae dominate and represent more than 99% of the catches. The ratio between the number of species and the number of specimens indicates an index of diversity higher than for Aphidoidea. None of the species was collected in sufficient numbers to be followed by the French Survey Network. It appears that the great majority of the species, with no more than 10 specimens for the whole network, flies below 12m, under the suction trap level. Such numbers are characteristic of short distance dispersal, not taken account of by the suction trap. Some catches provided new records of distribution in France: *Delphacodes capnodes* in Montpellier, *Edwardsiana smreczynskii* in Caen, *Ribautiana scalaris* in Rennes, *Opsius stactogalus* in Colmar. We can confirm the absence (or the great rarity) of *Laodelphax striatellus* in the north west and *Javesella pellucida* in the south east of the country. Unlike aphids, it seems difficult to use the data obtained for biological information, even for *J. pellucida* and *Z. scutellaris*, the 2 main species collected. The Agraphid network designed for the migration study of aphids of economical intrerest is not adapted for studying Auchenorrhyncha dispersal and their ecology through this information.

RESUME

Nous avons recensé 137 espèces, à partir des 10.790 spécimens capturés par le réseau Agraphid français, en 1994. Des 4 familles : Cixiidae, Delphacidae, Cercopidae et Cicadellidae, seules les Delphacidae et les Cicadellidae dominent et représentent plus de 99% des effectifs capturés. Le rapport entre le nombre d'espèces et le nombre de spécimens indique un indice de diversité supérieur à celui des pucerons. Aucune des espèces n'a été capturée en nombre suffisant pour qu'elle puisse être suivie par un réseau de surveillance. Il semble que les espèces, dont la majorité d'entre-elles présentent des effectifs ne dépassant pas 10 individus pour l'ensemble du réseau, se déplacent à une hauteur inférieure à celle du piège à succion, caractérisant une déplacement de courte distance qui n'est pas prise en compte par le réseau Agraphid. La capture, dans des régions où elles n'étaient pas connues, a permis d'augmenter l'aire de répartition de quelques espèces : *Delphacodes capnodes* à Montpellier, *Edwardsiana smreczynskii* à Caen, *Ribautiana scalaris* à Rennes, *Opsius stactogalus* à Colmar. Nous avons la confirmation de l'absence (ou de la grande rareté) de *L. striatellus* dans le nord ouest et de *J. pellucida* dans le sud est. Il semble difficile d'utiliser les données du réseau, même pour *J. pellucida* et *Z. scutellaris*, les 2 principales espèces récoltées. Le réseau Agraphid, installé pour le suivi des pucerons d'intérêt agronomique, n'est pas adapté à l'étude du déplacement des Auchenorrhyncha et à celle de leur écologie au travers de cette dernière information.

Mots-clés : Auchenorrhyncha, piège à succion, zoogéographie, fluctuation de population, vol migratoire, dispersion.

1. INTRODUCTION

The suction trap (fig. 1) was designed in Great Britain at the Rothamsted Experimental Station during the 1950s to study aphid dispersal and to predict the fluctuation of their populations in the different areas where these traps are situated (Macaulay et al, 1988). The height of 40 ft was chosen by the British workers as the interface which allowed the best representation of the aphid populations' pressure gradient, from the ground up to more than 1000m altitude (Robert & Choppin de Janvry, 1977). Another point of view is given by Moreau (1996): at the height of 12.3 m, catches from the surrounding area of the trap are mostly eliminated, giving a better appreciation of migratory activities.
This trap was adopted on the continent in the 1970s (France, 1977), so much so that the Euraphid Network has increased gradually and now includes 15 countries, with a total of 60 suction traps. In France, 13 stations were operating in 1994. Unfortunately for a general entomological study, the network is not regularly distributed in France, most of the traps are present in the northern part (Fig. 2). In France, 16 species of aphids are studied through the network catches. Their number depends on the year and the geographic situation of the trap so that the annual total of aphids collected varies between 250,000 specimens and 1,000,000 (in 1978, the record). For a single trap, the number of 50,000 aphids a year can be reached, with the predominance of one or two species (which may have little economic importance).
It was hoped to obtain similar results with other insect groups of applied importance, for the traps collect other insect groups like Diptera, Coleoptera, Thysanoptera, Psylloidea, as well as spiders. For other insect groups, these catches can increase, through migration, our knowledge of the French fauna and add to the knowledge of the bionomics of the collected species. Recently, several entomologists working on systematic or faunistic studies agreed to examine insects for which they are specialists, such as *Sitona* (Coleoptera) and *Chrysopa* (Neuroptera). We agreed to study Auchenorrhyncha collected in 1994 as a general approach to measure the efficiency of the network for this group of

families.

Auchenorrhyncha are not known in Europe to cause direct damage due to food ingestion (primary effects) in relation with population outbreaks as happens with aphids, but they have an economic impact because of their capacity to transmit diseases, several genera being efficient vectors for some viruses and nearly all phytoplasma to plants (secondary effects). It was considered worthwhile to determine the species collected and to follow the most economically important species through the survey network. Auchenorrhyncha have never been studied in France using the suction network, but a short study on *P. alienus* has been published due to the damage on wheat caused by this new pest (Moreau et al, 1992; Moreau, 1996). In Southern England, at Silwood (Ascot, Surrey), flight dispersal has been investigated by Waloff (1973), with the help of suction traps suspended at different heights and coloured plates (water traps). Suction trapping has been used to study Auchenorrhyncha associated with rice in the Philippines (*i. e.* Perfect et al, 1982; Perfect et al, 1985), but other devices are generally used (Chancellor et al, 1997).

2. MATERIALS AND METHODS

The aerial plankton is collected at a height of 12.3 m, throughout the year without interruption, by a powerful vacuum. Specimens fall in a bottle with water and detergent (teepol). This bottle is replaced every day, and so it is a 24h collection. The primary screening (screening I) separates aphids and the other insects studied from the rest of the arthropods collected. Aphidoidea are identified immediately and the other groups sent to the specialists, 2 or 3 times a year. Other insects are stored (in darkness) in their daily tubes.

The storage in water and alcohol created difficulties for identification since the delicate colours of insects like Typhlocybinae and Idiocerinae disappear after prolonged storage. The elongation of the abdomen sometimes makes length of flabby bodies difficult to measure. For these reasons, we did not attempt to name the majority of the numerous *Empoasca* females when males of different species were present simultaneously. This difficulty also includes some *Zygina* sp, *Kybos* sp and *Macrosteles* sp females. Damaged specimens with missing heads, abdomens, wings, etc. were not always easy to name!

For simplification purposes, the suction trap situated in La Verrière will be named Versailles; Loos en Gohelle will be called Lens; St Marcel les Valences: Valence; Fleury les Aubray: Orléans; Hérouville St Clair: Caen; Lavannes: Reims; Quenne: Auxerre; Le

Rheu: Rennes. The other stations are situated in the named localities. The trap situated in Ploudaniel, département du Finistère (Brittany), was studied for delphacids only. In this case, the whole network (13 suction traps) is concerned while for the other families (cicadellids included) we will work with only 12 traps.

Further information on *Z. scutellaris* is given by data obtained from 3 coloured plates (yellow traps), placed directly on the ground at INRA in Versailles in 1976 in a grassland (40m x 300m), situated between a wood and a maize field.

3. RESULTS

3.1. GENERAL REMARKS

Wing-dimorphism in the same population is a characteristic of a great number of Homoptera. Wing dimorphism was first studied in aphids (Bonnemaison, 1951), and depends on several environmental factors like host plant quality and population density. For instance, for both: hoppers and aphids, the number of macropters increases with intra or/and interspecific competition at the larval instars. Concerning Auchenorrhyncha, in interspecific competition, one of these species is sometimes able to be more active than the other (Denno & Roderick, 1992) and the wing form dimorphism depends on the type of habitat (Denno et al, 1996). For instance, the proportion of brachypterous specimens in temporary habitats is significantly lower than in permanent habitats (Novotny, 1994). Brachypters and macropters may have different functions. Female brachypters, smaller, are generally more fecund than female macropters (Denno et al, 1989) and can reproduce quickly in a persistent habitat. Macropters, with a larger body size, are capable of colonizing new areas. But other authors have observed the fecundity of both forms to be equivalent. For this study, an interesting case is given by Mochida (1973) and concerns *J. pellucida*. For migrants, it seems that it is a pre-mating flight, because after dissection of females of rice planthopper migrants (*S. furcifera* and *L. striatella*), none had sperm in their spermathecae, indicating that they had not mated before migrating (Noda, 1986).

The long-winged form seems to be the only morph of the collected specimens; for example, all the 4,264 delphacids are macropters (easier and more rapid to check than for several species of cicadellids) and determine the long-distance migrating category.

3.2. TOTAL NUMBER OF SPECIMENS AND SPECIES PER FAMILY COLLECTED BY EACH TRAP (Table I)

Part of the insect collections in Caen, Versailles, Angers and Orléans escaped our study because some of them were not removed during screening I. For instance, in Caen only 2 delphacid specimens (of the same species) were observed in 1994 (Table I) instead of 90 (3 species) noted in 1996 for the full catch. We managed to participate in the screening I of more than half of the traps and we presume that the numbers for these traps were practically complete.

The number of specimens per site varied but was never large and illustrates that where the trap is located is more important for Auchenorrhyncha than for aphids. This is probably the reason why the number of specimens collected in Montpellier is very low, compared to those of Valence (only 22.5% of the number of the latter). The trap is placed in the park of the Agricultural School in Montpellier and is completely surrounded by the town. This situation begins to be similar for Orléans, Versailles and several other traps.

		Cixiidae			Delphacidae			Cercopidae			Cicadellidae		
Locality	Tn	Nos	Nsi	Nsu	Nos	Nsi	Nsu	Nos	Nsi	Nsu	Nos	Nsi	Nsu
Ploudaniel	57	0	0	0	56	3		0	0	0	1	1	0
Caen	177	0	0	0	2	1	0	0	0	0	175	9	25
Versailles	316	0	0	0	194	7	0	0	0	0	122	19	21
Angers	347	0	0	0	261	14	0	0	0	0	86	15	21
Montpellier	429	2	0	2	170	6	0	0	0	0	257	31	49
Orléans	444	0	0	0	351	10	0	0	0	0	93	14	23
Auxerre	666	1	0	1	338	7	0	2	2	0	325	29	50
Lens	876	0	0	0	725	3	0	0	0	0	151	11	15
Poitiers	950	2	0	2	77	7	0	0	0	0	871	16	100
Colmar	1321	0	0	0	46	5	0	0	0	0	1275	44	8
Reims	1455	0	0	0	1342	6	0	1	1	0	112	11	48
Rennes	1860	0	0	0	345	13	0	0	0	0	1515	26	98
Valence	1892	2	1	1	357	8	3	0	0	0	1533	36	207
Total	10790	7		6	4264		3	3		0	6516		665

Table I. Number of specimens collected per family and trap, in 1994. The traps are presented according to the increasing order of collected insects. Tn: Total number of specimens caught per trap; Nos: Number of specimens caught per family ; Nsi: Nunber of species identified ; Nsu: Number of specimens undetermined

3.3. NUMBER OF IDENTIFIED SPECIES AND LIST OF THE SPECIES PER FAMILY

In 1994, 10,790 Auchenorrhyncha specimens were observed, comprising 137 species belonging to 4 of the 14 families known to be present in France. However, more than 99% belonged to the 2 numerically most important French families.

Number of specimens (in increasing order): Cercopidae (sensu Nast, 1987 [Aphrophorinae are included]): 3 ; Cixiidae: 9; Delphacidae: 3,860; Cicadellidae: 6,507.

Most of the 137 identified species were represented in very low numbers, 107 species (78% of the total species) do not reach 11 specimens, and among them 51 (37%) had only single specimen. These numbers are an indication of accidental collecting and possibly an indication that Auchenorrhyncha are poor fliers, only able to migrate short distances.

Comparatively, 2 species, the delphacid *J. pellucida* and the cicadellid *Z. scutellaris*, were present in numbers, with more than 1,000 specimens each. The total of 137 species out of 10,790 specimens represents a high index of diversity. This gives a mean of 80 specimens per species which is a much smaller mean than for aphids (1,195 specimens per species). For aphids 343,000 specimens were collected in 1994 (30 times more than the Auchenorrhyncha), and 216 species were identified (287 at the genus level) (Hullé, pers. comm.). In Silwood (UK), 115 species of Auchenorrhyncha were collected through the numerous and different traps used, representing a third of the British fauna (Waloff, 1973). For 12 traps placed in different areas in France, we obtained only a sixth of the French fauna, which is around 850 species.

The total number of males (5,553) was close to the number of females (5,228). Females generally seemed to be as mobile as males, and their dispersal capacity used the same height. But this conclusion may be different according to each species.

Catches are gathered by family, genera, species and by trap. The localities are in alphabetic order. The classification is according to Nast (1987).

3.31. CIXIIDAE (Table II)

The French fauna includes 35 species (Nast, 1987).

CIXIIDAE= 7 specimens, 3 genera	Trap localities and number of specimens collected	Total No
Cixius sp	Montpellier 1, Poitiers 2, Valence 1	4
Hyalesthes sp	Auxerre 1	1
Hyalesthes luteipes Fieber, 1876	Valence 1	1
Oliarus sp	Montpellier 1	1

Table II. Species of Cixiidae collected through the network, their total numbers and the number of specimens caught by each suction trap. Genera are placed in alphabetical order.

3.32. DELPHACIDAE (Tables III and IV)

The 29 species identified belong to 23 genera. As the French fauna includes 129 species (della Giustina et Remane, in press), the proportion of delphacid species collected by the suction network represents 22% of the French fauna.

DELPHACIDAE= 4264 specimens, 23 genera, 29 species	Trap localities and number of specimens collected	Total No
Kelisia guttula (Germar, 1818)	Montpellier 1, Orléans 1	2
Stenocranus minutus (F., 1787)	Angers 1, Rennes 2, Versailles 1	4
Stenocranus major (Kirschbaum, 1868)	Rennes 2	2
Conomelus anceps (Germar, 1821)	Orléans 1	1
Megamelus notula (Germar, 1830)	Angers 1	1
Eurysa lineata (Perris, 1857)	Rennes 1	1
Eurybregma nigrolineata Scott, 1875	Orléans 1	1
Scottianella dalei (Scott, 1870)	Angers 1	1
Euconomelus lepidus (Boheman, 1847)	Angers 2, Rennes 2	4
Delphax ribautianus Asche et Drosopoulos, 1982	Valence 1	1
Chloriona glaucescens Fieber, 1866	Montpellier 8	8
**Laodelphax striatellus* (Fallén, 1826)	Angers 42, Auxerre 24, Colmar 38, Montpellier 54, Orléans 23, Poitiers 17, Reims 3, Rennes 2, Valence 253, Versailles 5	461
Ditropsis flavipes (Signoret, 1865)	Poitiers 1	1
Hyledelphax elegantulus (Boheman, 1847)	Angers 1, Rennes 1	2
Delphacodes mulsanti (Fieber, 1866)	Angers 30, Auxerre 2, Orléans 1, Rennes 3, Versailles 2	38
**Delphacodes capnodes* (Scott, 1870)	Montpellier 3	3
Muellerianella extrusa (Scott, 1871)	Ploudaniel 2, Poitiers 2, Reims 1, Rennes 1	6

Muirodelphax aubei (Perris, 1857)	Valence 1	1
Acanthodelphax spinosus (Fieber, 1866)	Angers 3	3
Dicranotropis hamata (Boheman, 1847)	Auxerre 1, Lens 1, Orléans 1, Poitiers 2, Reims 1, Rennes 4, Valence 1	11
Xanthodelphax stramineus (Stål, 1858)	Angers 6, Orléans 2, Rennes 1, Versailles 2	11
**Paradelphacodes paludosa* (Flor, 1861)	Colmar 1	1
Toya propinqua (Fieber, 1866)	Angers 22, Colmar 4, Montpellier 102, Valence 88	216
**Javesella pellucida* (F., 1794)	Angers 76, Auxerre 300, Caen 2, Colmar 1, Lens 723, Orléans 312, Ploudaniel 42, Poitiers 39, Reims 1332, Rennes 255, Valence 4, Versailles 182	3268
**Javesella dubia* (Kirschbaum, 1868)	Angers 65, Auxerre 8, Colmar 2, Lens 1, Montpellier 2, Orléans 8, Ploudaniel 12, Poitiers 14, Reims 4, Rennes 62, Valence 5, Versailles 1	184
Javesella obscurella (Boheman, 1847)	Angers 9, Auxerre 2, Reims 1, Rennes 9	21
Ribautodelphax sp	Valence 3	3
Ribautodelphax albostriatus (Fieber, 1866)	Orléans 1, Versailles 1	2
Ribautodelphax collinus (Boheman, 1847)	Angers 2, Poitiers 2, Valence 1	5
Ribautodelphax imitans (Ribaut, 1953)	Auxerre 1	1

Table III. Delphacidae species collected through the network, their total numbers and the number of specimens caught by each suction trap. Species are presented according to the Systematic order. (*) indicates species which are discussed in the following pages.

It seems interesting for us to present the delphacids species by classes of catches to note the fraquency of their collecting as indicated Table IV.

Ns	1	2	3-5	6-10	11-17	18-30	31-56	57-100	101-170	171-300	301-560	561-1000	>1000
Nsp	10	4	5	2	2	1	1	0	0	2	1	0	1

Table IV. Number of Delphacidae species identified, presented by classes of catches. Class 1 = 1 specimen collected. Class 4 = 6-10 specimens caught. Ns: Number of specimens ; Nsp: Number of species.

Each species is placed in a class according to the total number of specimens collected by the whole network. These classes indicate that 10 species were collected only once (1 specimen only), and 21 species (72.4% of the delphacid species) were collected not more than 10 times for the total network (Table III).

3.33. CERCOPIDAE (Table V)

The French fauna currently includes 19 species (Nast, 1987).

CERCOPIDAE= 3 specimens, 3 genera, 3 species	Trap localities and number of specimens collected	Total No
Neophilaenus exclamationis (Thunberg, 1784)	Auxerre 1	1
Aphrophora salicina (Goeze, 1778)	Auxerre 1	1
Philaenus spumarius (L., 1758)	Reims 1	1

Table V. Cercopidae species collected through the network, their total numbers and the number of specimens caught by each suction trap.

Three species were collected, 1 specimen each. Among them, *Philaenus spumarius* widespread in the Holarctic region, is one of the most common Auchenorrhyncha in France.

3.34. CICADELLIDAE (Tables VI and VII)

Among the 514 species known in France (Nast, 1987; della Giustina, 1989), 104 species (distributed in 61 genera) were identified, giving a ratio of 1: 5.2, approximately similar to the Delphacidae. The species belong to 9 of the 14 sub-families forming the Cicadellidae in France. The Typhlocybinae (6,193 = 95% of the total) dominate. This importance is due to the presence of many *Empoasca* (all species included) and more *Z. scutellaris* specimens. At the genus level, 22 genera were found for Delphacinae and 24 genera for Typhlocybinae, for a total of 31 Deltocephalinae species and 54 Typhlocybinae ones.

CICADELLIDAE= 6516 specimens, 61 genera, 104 species	Trap localities and number of specimens collected	Total No
Megophthalmus scanicus (Fallén, 1806)	Angers 1	1
Oncopsis sp	Colmar 1	1
Oncopsis flavicollis (L., 1761)	Auxerre 2, Colmar 3,	18

	Lens 4, Versailles 9	
Oncopsis carpini (J. Sahlberg, 1871)	Auxerre 1, Colmar 1, Orléans 1	3
Oncopsis alni (Schrank, 1801)	Colmar 2	2
Macropsis sp	Auxerre 1, Colmar 4, Poitiers 1	6
Macropsis graminea (F., 1798)	Colmar 3	3
Agallia consobrina Curtis, 1833	Montpellier 1	1
Anaceratagallia venosa (Fourcroy, 1785)	Valence 1	1
Anaceratagallia laevis (Ribaut, 1935)	Montpellier 2	2
Anaceratagallia ribauti Ossiannilsson, 1938	Angers 1, Reims 1, Rennes 2	4
Austroagallia sinuata (Mulsant et Rey, 1855)	Montpellier 3, Poitiers 1, Valence 3	7
Idiocerinae sp	Colmar 1, Montpellier 1, Orléans 1, Valence 2, Versailles 3	8
Tremulicerus distinguendus (Kirschbaum, 1868)	Auxerre 1, Orléans 1	2
Rhytidodus decimusquartus (Schrank, 1776)	Versailles 1	1
Populicerus nitidissimus (Herrich-Schäffer, 1835)	Montpellier 4, Versailles 1	5
Metidiocerus impressifrons (Kirschbaum, 1868)	Versailles 1	1
Idiocerus vicinus Melichar, 1898	Colmar 4	4
Iassus scutellaris (Fieber, 1868)	Angers 1	1
Eupelix cuspidata (F., 1775)	Valence 1	1
Aphrodes makarovi Zachvatkin, 1948	Orléans 1, Rennes 1	2
Anoscopus assimilis (Signoret, 1879)	Angers 1	1
Zygina sp	Angers 1, Auxerre 6, Colmar 2, Lens 1, Montpellier 4, Reims 1, Rennes 7	22
**Zygina nivea* (Mulsant et Rey, 1855)	Caen 1, Colmar 17, Montpellier 21, Valence 6	45
Zygina angusta Lethierry, 1874	Auxerre 6, Lens 1, Montpellier 1, Rennes 2, Versailles 1	11
Zygina flammigera (Fourcroy, 1785)	Auxerre 3, Caen 4, Colmar 7, Orléans 1, Poitiers 2, Reims 2, Rennes 4, Valence 13, Versailles 3	39
Zygina rhamni Ferrari, 1882	Montpellier 2	2
**Fruticidia bisignata* (Mulsant et Rey, 1855)	Auxerre 10, Caen 2, Colmar 17, Montpellier 9, Poitiers 10, Rennes 2, Valence 10	60
**Zyginidia scutellaris* (Herrich-Schäffer, 1838)	Angers 37, Auxerre 187, Caen 101, Colmar 969,	4577

	Lens 106, Montpellier 55, Orléans 46, Ploudaniel 1, Poitiers 619, Reims 31, Rennes 1289, Valence 1073, Versailles 63	
Hauptidia sp	Montpellier 1	1
**Hauptidia maroccana* (Melichar, 1907)	Rennes 1	1
Arboridia sp	Colmar 4, Orléans 1, Poitiers 14, Rennes 3, Valence 1, Versailles 1	24
Arboridia ribauti (Ossiannilsson, 1937)	Rennes 1	1
Arboridia velata (Ribaut, 1952)	Colmar 3	3
Alnetoidia alneti (Dahlbom, 1850)	Rennes 1, Versailles 1	2
Fagocyba douglasi (Edwards, 1878)	Orléans 2, Valence 1	3
Edwardsiana sp	Angers 1, Auxerre 3, Caen 1, Colmar 14, Lens 1, Montpellier 4, Reims 1	25
Edwardsiana rosae (L., 1758)	Auxerre 2, Colmar 6, Versailles 1	9
Edwardsiana avellanae (Edwards, 1888)	Auxerre 1	1
Edwardsiana candidula (Kirschbaum, 1868)	Colmar 1	1
Edwardsiana flavescens (F., 1794)	Colmar 2, Reims 1, Valence 1	4
Edwardsiana frustator (Edwards, 1908)	Colmar 1, Valence 1	2
Edwardsiana gratiosa (Boheman, 1852)	Colmar 1, Reims 1	2
Edwardsiana hippocastani (Edwards, 1888)	Angers 1, Rennes 1	2
**Edwardsiana platanicola* Vidano, 1961	Colmar 9, Montpellier 26, Rennes 1	36
**Edwardsiana rosaesugans* (Cerutti, 1936)	Colmar 1	1
**Edwardsiana smreczynskii* Dworakowska, 1971	Caen 1	1
Linnavuoriana sexmaculata (Hardy, 1850)	Auxerre 1, Colmar 2, Rennes 2	5
Linnavuoriana decempunctata (Fallén, 1806)	Rennes 1	1
Ficocyba ficaria (Horváth, 1897)	Valence 1	1
Lindbergina aurovittata (Douglas, 1875)	Auxerre 10, Caen 6, Colmar 3, Montpellier 16, Poitiers 8, Valence 50, Versailles 4	97
Ribautiana ulmi (L., 1758)	Auxerre 2, Colmar 1	3
Ribautiana cruciata (Ribaut, 1931)	Angers 3, Auxerre 1, Montpellier 5, Orléans 1, Rennes 1	11
Ribautiana debilis (Douglas, 1876)	Angers 2, Auxerre 6, Caen 19, Colmar 1, Rennes 35, Versailles 2	65
**Ribautiana scalaris* (Ribaut, 1931)	Montpellier 1, Rennes 1	2
Ribautiana tenerrima (Herrich-Schäffer, 1834)	Auxerre 4, Colmar 4, Montpellier 5, Poitiers 1,	35

	Valence 21	
Zonocyba bifasciata Ribaut, 1936	Auxerre 1	1
Typhlocyba quercus (F., 1777)	Angers 1, Auxerre 1, Colmar 1, Montpellier 2, Rennes 2, Valence 1, Versailles 1	9
Eurhadina sp	Auxerre 2, Caen 1, Orléans 2, Reims 1, Rennes 2, Versailles 1	9
Eurhadina pulchella (Fallén, 1806)	Reims 1	1
Eurhadina concinna (Germar, 1831)	Auxerre 1, Valence 1	2
Eurhadina ribauti Wagner, 1935	Auxerre 2, Versailles 1	3
Eupteryx sp	Auxerre 5, Colmar 1, Lens 1, Reims 1	8
Eupteryx atropunctata (Goeze, 1778)	Lens 4	4
Eupteryx aurata (L., 1758)	Auxerre 1, Caen 2, Lens 1, Orléans 1, Poitiers 44, Reims 4, Rennes 1, Valence 2	56
Eupteryx curtisii (Flor, 1861)	Angers 1, Valence 1	2
Eupteryx decemnotata Rey, 1891	Colmar 1	1
Eupteryx stachydearum (Hardy, 1850)	Colmar 2, Rennes 2	4
Eupteryx zelleri (Kirschbaum, 1868)	Montpellier 1	1
Zyginella pulchra Löw, 1885	Colmar 4, Lens 5, Orléans 1, Rennes 1	11
Kybos sp	Colmar 8, Lens 1, Poitiers 1, Versailles 1	11
Kybos luda Davidson et Delong, 1938	Colmar 3	3
Kybos virgator Ribaut, 1933	Colmar 5	5
Kybos populi Edwards, 1908	Colmar 3, Lens 1	4
Empoasca sp	Angers 15, Auxerre 30, Caen 23, Colmar 76, Lens 11, Montpellier 28, Orléans 8, Poitiers 73, Reims 42, Rennes 86, Valence 170, Versailles 7	569
**Empoasca vitis* (Göthe, 1875)	Angers 8, Auxerre 13, Caen 14, Colmar 23, Lens 8, Montpellier 15, Poitiers 56, Reims 9, Rennes 23, Valence 15, Versailles 3	187
**Empoasca decipiens* Paoli, 1930	Angers 1, Auxerre 2, Colmar 3, Lens 4, Poitiers 9, Reims 3, Rennes 7, Valence 8, Versailles 1	38
**Empoasca affinis* Nast, 1937	Auxerre 4, Colmar 6, Poitiers 1, Reims 10	21

**Empoasca pteridis* (Dahlbom, 1850)	Auxerre 7, Colmar 21, Poitiers 8, Rennes 31, Valence 8	75
**Asymmetrasca decedens* (Paoli, 1932)	Valence 61	61
Liguropia juniperi (Lethierry, 1876)	Colmar 1, Lens 1, Valence 1	3
Erythria aureola (Fallén, 1806)	Valence 1	1
Emelyanoviana mollicula (Boheman, 1845)	Auxerre 1, Colmar 2, Valence 4	7
Dikraneura variata Hardy, 1850	Rennes 1	1
Grypotes puncticollis (Herrich-Schäffer, 1832)	Valence 1	1
Grypotes staurus Ivanoff, 1885	Montpellier 9	9
**Opsius stactogalus* Fieber, 1866	Colmar 1	1
**Opsius lethierryi* Wagner, 1941	Montpellier 1	1
Macrosteles sp	Colmar 1, Montpellier 2, Valence 2	5
Macrosteles laevis (Ribaut, 1927)	Colmar 13, Montpellier 1, Valence 5	19
Macrosteles quadripunctulatus (Kirschbaum, 1868)	Montpellier 1	1
Macrosteles sexnotatus (Fallén, 1806)	Reims 1	1
Balclutha punctata (F., 1775)	Angers 1, Auxerre 1, Colmar 2, Orléans 3, Poitiers 1, Rennes 3, Valence 3, Versailles 2	16
Balclutha frontalis (Ferrari, 1876)	Montpellier 1	1
Deltocephalus pulicaris (Fallén, 1806)	Montpellier 1	1
Recilia schmidtgeni (Wagner, 1939)	Valence 4	4
Chiasmus conspurcatus (Perris 1857)	Montpellier 3	3
Aconurella prolixa (Lethierry, 1885)	Montpellier 5	5
Anoplotettix fuscovenosus (Ferrari, 1882)	Montpellier 1	1
Allygus modestus Scott, 1876	Colmar 1, Valence 10	11
Allygidius atomarius (F., 1794)	Valence 1	1
Sardius argus (Marshall, 1866)	Angers 1	1
Cicadula quadrinotata (F., 1794)	Orléans 1, Rennes 1	2
Cicadula placida (Horváth, 1897)	Valence 1	1
Mocydia crocea (Herrich-Schäffer, 1836)	Valence 1, Versailles 1	2
Euscelidius variegatus (Kirschbaum, 1858)	Colmar 1, Lens 1, Poitiers 1, Valence 1	4
Conosanus obsoletus (Kirschbaum, 1858)	Colmar 1	1
Euscelis lineolatus Brullé, 1832	Orléans 1	1
Euscelis incisus (Kirschbaum, 1858)	Colmar 1, Poitiers 1, Versailles 1	3
Araldus propinquus (Fieber, 1869)	Montpellier 5	5
Psammotettix sp	Angers 4, Auxerre 3, Colmar 6, Montpellier 9, Orléans 11, Poitiers 11, Reims 2, Valence 32,	86

	Versailles 8	
**Psammotettix alienus* (Dahlbom, 1851)	Auxerre 1, Montpellier 6, Orléans 9, Poitiers 3, Valence 7, Versailles 4	30
Psammotettix confinis (Dahlbom, 1850)	Angers 5, Auxerre 2, Colmar 2, Montpellier 3, Poitiers 6, Valence 5	23
Psammotettix helvolus (Kirschbaum, 1868)	Colmar 2, Valence 2	4
Adarrus taurus (Ribaut, 1952)	Montpellier 1	1
Jassargus distinguendus (Flor, 1861)	Auxerre 1	1
Arthaldeus striifrons (Kirschbaum, 1868)	Montpellier 1, Orléans 1	2

Table VI. Cicadellidae species collected through the network, their total numbers and the number of specimens caught by each suction trap. Species are presented after the Systematic order. (*) indicates species which are discussed in the following pages.

Ns	1	2	3-5	6-10	11-17	18-30	31-56	57-100	101-170	171-300	301-560	561-1000	>1000
Nsp	37	15	24	5	5	5	6	5	0	1	0	0	1

Table VII. Number of leafhopper species identified, presented by classes of catches. Class 1 = 1 specimen collected. Class 4 = 6-10 specimens caught. Ns: Number of specimens ; Nsp: Number of species.

Like for Delphacidae, Cicadellidae specimens were classified according to their total numbers. One species (*Z. scutellaris*) was collected in large numbers, 37 were found only once, and 81 (77.8% of the total) less than 11 times (Table IV).

3.4. NOTES ON INDIVIDUAL SPECIES OF PARTICULAR INTEREST

3.41. DELPHACIDAE

***Laodelphax striatellus* (Fallen) (Fig. 3).**

We noted 461 specimens (248 males and 213 females). Its distribution is not homogeneous in France being very rare if not absent from the north west of France. Perhaps the main reason why it was not caught in Lens and Caen. It has not been swept by the authors in the north west, and is not cited in the "département du Nord" by Lethierry (1874). It is rare in the UK although known in Ireland (Le Quesne, 1960), but nevertheless widely distributed in the Palaearctic and Oriental Regions. It hibernates as diapausing larvae in the northern regions of Europe (Ossiannilsson, 1978) and it is probably the same in France. This diapausing phase is perhaps absent from the southern part of France, as noted by Harpaz (1972) for Israel, but this has not proved yet. Specimens in the field are rarely brachypterous.

Different geographical populations in Japan show a cytoplasmic incompatibility among themselves (Noda, 1987). It would be interesting to study French populations which seem to have different biological properties.

Found on different grasses, including several cultivated cereals, *L. striatellus* is of economic interest as the vector of Rice Stripe Tenuivirus in Asia. In Europe, it is known to transmit the Barley Yellow Striate Mosaic and the Cereal Tillering Disease. In the south west of France, it is the vector of Maize Rough Dwarf due to a Reovirus (Fijivirus) causing serious damage in recent years (Signoret & Alliot, 1994).

We could note some dispersal activity during the summer season (Fig. 3). The 253 catches in Valence are the only ones which show a peak of activity in July and August. Numbers are low for the whole network, suggesting that migrating flights are rare, except for short distances. Kisimoto (1969) has shown that *L. striatellus* flights did not exceed a few kilometers.

Delphacodes capnodes **(Scott)**

The 3 specimens collected in Montpellier (Herault) are a new record for the Western part of the French Mediterranean Basin. This species is specific to wet areas and known to live on *Carex riparia* in Greece (Drosopoulos et al, 1983).

Paradelphacodes paludosa **(Flor)**

This species is known from north and central Europe. The unique specimen, collected in Colmar, is interesting because this species seems rare in France, with a geographical distribution restricted so far to a small area of the eastern part of France (Alsace), where we collected it only once by sweeping (della Giustina et al, 1997). While it is relatively widespread in the Palaearctic region, (it is found in Far Eastern regions such as: Mongolia, Maritime Territory), it seems rare everywhere (Ossiannilsson, 1978).

Javesella pellucida **(F.) (Fig. 4 & 5)**

Found in 12 of the 13 traps, often in abundance, we have identified 3268 specimens (1767 ♂: 1501 ♀), corresponding to 76.6% of the total Delphacidae numbers, with a sex ratio 1 ♂: 0,8 ♀. An Eurosiberian distribution up to the Far East, it is present in the Oriental region. In Silwood Park (Southern England), the sex ratio was 1 ♂: 1 ♀ (Waloff, 1973). As in England, *J. pellucida* is one of the most common species in France. We received only 2 specimens of *J. pellucida* from Caen in 1994, but we found 70 in 1996. More important is its absence from Montpellier and the presence of only 4 specimens in

Valence (Fig. 4). These observations confirm what we know about its distribution in France. *J. pellucida* is very rare in the south east of France, including Corsica (where it seems to have never been collected so far). It also seems rare, if not absent, from the French Alps (Remane & della Giustina, 1994). Valence and west of Montpellier must represent its geographical limit. An oligophagous insect (Poaceae), hibernating in the larval stage and plurivoltine (3 or 4 generations/year). In fields, macropters are more frequent than brachypters, which is why it is found in numbers in the suction traps. *J. pellucida* is a pest in some countries because of the toxicity of its saliva and the viruses it transmits to cereals: the European Wheat Striate Mosaic, the Oat Sterile Dwarf, the Maize Rough Dwarf and the Arrhenatherum Blue Dwarf.

J. pellucida was found practically only during 4 weeks, between the 27th and the 30th week of the year, the largest number was collected for only one week for most traps, except for Reims (Fig. 5). This peak of activity and smaller peaks in April and September do not seem to indicate the migratory flights in spring from areas where populations are hibernating and their return in autumn as observed in Finland by Raatikanen (1967 and 1972). These dispersals must be short distance movements.

The successive nutritional exploitation of different host plants, necessitating migrating dispersal has been shown by Prestidge & McNeill (1982). Long range displacement occurs only in warm temperatures and with the presence of wind (Kanervo et al, 1957; Waloff, 1973). The flight curve indicates the presence of 2 successsive generations in Silwood Park (Waloff, 1973), probably because the traps were placed at a height lower than 12.3m. Migration activity by *J. pellucida* is likely to be diurnal (Raatikainen, 1967), but this was not shown by the daily catches of the French suction network. After the classification of Waloff (1973), *J. pellucida* belongs to a group in which macropters have their flight ability greatly diminished or lost with egg maturation and age.

***Javesella dubia* (Kirschbaum)**

Only 184 specimens were identified, from 11 sites, around 18 times less than the numbers of *J. pellucida*. If it is absent from the traps situated in Caen and Lens it is normaly present in the north west of France and was caught, for instance, by sweeping in Arques (Pas de Calais) (della Giustina & Remane, 1992b). A Euro-Mediterranean distribution, it is known to be present only in the Palaearctic region, with a smaller distribution in the Far East than *J. pellucida*. In France, *J. dubia* seems as widely distributed as *J. pellucida*, if not more. It is present in the south east of France, Vaucluse (della Giustina & Remane, 1992a), the Alps and Corsica (Remane & della Giustina, 1994), an area where *J.*

pellucida is very rare. *J. dubia* must be a species with few long range fliers. Known to live on many graminaceous plants, it is a vector of the European Wheat Striate Mosaic.

3.42. CICADELLIDAE

Zygina nivea **(Mulsant et Rey)**

Found on a range of different Salicaceae, *Z. nivea* is more widely distributed than shown by Ribaut (1936) who indicates only the southern part of France. It was collected on *Populus alba*, in September 1989, near Orléans (della Giustina rec.). Its collection by the suction traps of Caen and Colmar provides new distributions for France. *Z. nivea* presents a central and south European distribution.

Fruticidia bisignata **(Mulsant et Rey)**

Few specimens (60) were collected by the network, but they were found in 7 traps. Its previous distribution by Ribaut (1936) indicated several « Départements » in southern France, as for *Z. nivea*. As far as we know, no further localities have been added up until now. Rennes, Caen and Colmar notably increase its French distribution. It is known to be present in central and southern Europe.

Zyginidia scutellaris **(H.-S) (Fig. 6, 7 and 8)**

This was the only species to be collected in large numbers (2507 ♂ et 2070 ♀) by the 12 traps, representing 42% of the total Auchenorrhyncha and 70.2% of the Cicadellidae population. Males are more active than females, which is probably why the sex ratio is 1♂: 0,82♀. The sex ratio calculated by Waloff (1973) in Silwood Park is significantly different 1♂: 1,6♀; but *Z. scutellaris* is not a common species in this area and was collected by different types of traps placed at different heights.

Widely distributed in France, it is one of the most common French species (della Giustina, 1989). It is widespread in Europe, except for Scandinavia. As a mesophyll feeder, the damage on maize appears like pale stripes, most frequent on the first leaves, at the beginning of plant growth. The feeding mechanism has been studied by Marion-Poll et al, (1987). So far, it is not a pest in France but in several localities of the south west some damage is caused to maize cultivated for seed production especially and needed experiments for its chemical control (Naibo et al., 1991). *Z. scutellaris* is plurivoltine, hibernating at the egg stage, but some adults can survive during the winter (Fig. 8). It feeds on a large range of different grasses, but maize seems the most favourable host plant. The maize culture in France (3,500,000 ha) is probably an important parameter for the development of *Z. scutellaris* since this Poaceae has a summer activity, a period where many indigenous grasses are dried. After the middle of August, there is interspecific competition with several aphids, especially *Rhopalosiphum padi*, when populations of the latter increase, up to the end of September (Chansigaud & Vaillant, 1986). During the summer, *Z. scutellaris* can survive for quite a while on several dicotyledons (della Giustina & Caruhel, 1989).

Flight activity begins in June and probably corresponds to the migrating flight of the populations from graminaceous plants, such as wheat, barley and wild grasses, to the young maize, a few weeks after its sowing (Fig. 7). The peak catch occurs at the end of July till the beginning of August and corresponds mainly to adults of the first generation developed on maize. Populations then decrease progressively until mid October. Adults of *Z. scutellaris* fly back to other Poaceae at the end of September, when the maize is drying. Young wheat and barley plants are quickly colonized in October, as soon as they begin to grow after sowing. But adult populations decrease quickly with the cold and wet weather in the second part of October and November, even though some can survive during the cold period of the year (♀ mainly). Before disappearing in the first part of autumn, many females deposit eggs on young leaves of their cereal host plants. These spring and autumnal dispersals must be of a short distance, from one field to another, and are not recorded by the suction trap.

The lack of insects collected during winter by the suction traps is due to the relatively low activity linked with bad weather conditions. During this period of the year, the population moving is recorded only through traps placed just above the ground level, as studied in 1976 by della Giustina (unpublished but briefly indicated Fig. 8).

Hauptidia maroccana **(Melichar)**

A single specimen was collected in Rennes where it is now a pest of cultivated plants in glasshouses in Brittany. Its development was assisted recently on tomato using biological control and restricting pesticides, which contribute to the development of new pests like Thysanoptera and *H. maroccana*. This species is also present in England, in glasshouses (Hussey et al, 1969). Also known in UK in the open, the Iberian Peninsula and France (Nast, 1987) it is only noted in the south west of the later and rare (Ribaut, 1936). Its presence in Brittany is probably due to international exchanges of plants between different regions of production and to the warmer conditions existing in this special biotope. *H. maroccana* is known to live on different dicotyledons. To control this new pest, the use of *Anagrus atomus* L. (Mymaridae), an egg parasitoid has been studied (Maisonneuve et al, 1995).

Genus *Edwardsiana*

One of the largest genera in France with 24 species recorded (della Giustina, 1989). Always found in small numbers in the traps, 10 species are present in this study (59 ♂). New distributions of three species were found through the traps.

***Edwardsiana platanicola* Vidano**

E. platanicola, described in north Italy, was found in France in the Mediterranean area and was collected later more in the north, in Richelieu (Indre et Loire). Its presence in Rennes and Colmar indicates a wider distribution, approximately the same as its host-plant.

***Edwardsiana rosaesugans* (Cerutti)**

Known to live on *Rosa pendulina*, *E. rosaesugans* is cited only from Gragnolet (Isère) and Massif de l'Authion (Alpes Maritimes) for France (della Giustina, 1989). Its presence in Colmar increases its distribution in the direction of the north east. The species is known up to ex Czechoslovakia (Lauterer, 1983) and a mountain area of South Wales (UK) (Claridge & Wilson 1978). It was indicated more recently from Germany, even it was collected a long time ago (Remane & Fröhlich, 1994).

***Edwardsiana smreczynskii* Dworakowska**

Living on several trees, it is found on *Ulmus scabra* in France. Described from Poland, in France it has been found in Paris and known only in these 2 countries for a long time. It was caught in Germany by Nickel (in press). Collected by the trap in Caen, its distribution is now more widespread in France, but a very poor population is concerned because only 1 male was collected in 1994, none in 1996.

***Ribautiana scalaris* (Ribaut)**

This species is known to live on *Quercus*. It has so far not been collected by the authors in the field. The single specimen found in Montpellier corresponds to the information given by Ribaut (1936), indicating only 2 localities in Haute Garonne. The specimen collected in Rennes is more interesting, being far away to the north of its known distribution. This species is quite abundant on *Q. cerris* in South Wales (Claridge & Wilson, 1976).

Genus *Empoasca*

Unlike the *Kybos* genus, the *Empoasca* species are well represented with a number of 889 specimens. The 4 most common species, frequently found together in the same habitat, are widely distributed in France. In this study, the four species were collected by 3 traps: Auxerre, Colmar and Poitiers.

Empoasca vitis **(Göthe)**

Adults overwinter on evergreen trees and shrubs and then migrate to vines, and many other trees (Claridge & Wilson, 1976) in April, before the complete development of young leaves. There are 3 or 4 generations per year in France (Bonfils et Leclant, 1972). On vines, their feeding causes a yellowing discoloration and a marginal drying of the leaves, followed by their early fall. *E. vitis* is known to provoke the same damage on apple trees.

We could identify 187 specimens, coming from 11 of the 12 suction traps. We suppose that the absence of ♂ *E. vitis* in Orléans is probably due to the fact that the trap is situated in the suburbs. This species is widespread in Europe.

Empoasca decipiens **Paoli;** ***E. affinis*** **Nast;** ***E. pteridis*** **(Dahlbom)**

Only males were identified, as indicated. Frequently sympatric in the field, their association can vary in time and space. *E. decipiens* and *E. pteridis* are widely distributed in Europe but *E. affinis* seems to have a smaller distribution. *E. decipiens* is known to be responsible for important damage to fruit trees in citrus orchards around the Mediterranean Sea.

For the 4 species (*E. vitis* included), 320 ♂ and 569 ♀ were counted. The sex ratio was 1♂: 1,7♀.

Asymmetrasca decedens **(Paoli)**

61 specimens were identified, all of them from Valence (28♂, 33♀). There are large populations of this species, close to the *Empoasca* genus in peach orchards around Nîmes (Gard) where they cause leaf necrosis. Catches, except for the first one (10 August), are relatively late in the year, between October 3rd and November 22nd and can correpond to a migration linked with the physiological state of the leave.

Genus *Opsius*

The *Opsius* genus includes 2 species in France, both on *Tamarix* sp. These 2 species, with a very close habitus, but they seem to be allopatric. Both of them were collected in 1994. The *O. stactogalus* specimen caught in Colmar is interesting from the chorological point of view. It seems to indicate a more northern distribution for this species than for the other, because it was also collected by the senior author in Etaples (Pas de Calais). *O. stactogalus* is usually found along the coast of England (Le Quesne, 1969), and common in south Wales.

Genus *Psammotettix*

The identification of these species is extremely difficult and it is clear that techniques other than morphology might be needed. Among the 17 species recognized in the French fauna, 3 of them are common and widely distributed (della Giustina, 1989). These 3 species, *P. confinis, P. helvolus* and *P. alienus*, have been collected in Valence, but only *P. alienus* and *P. confinis* in Poitiers and Colmar. These species are frequently found in the same habitat, but not necessarily on the same host-plants.

Only males (57 specimens) were identified to species, not the 86 females. *P. alienus* is the only species to have any economic impact in France.

***Psammotettix alienus* (Dahlbom)**

Caught by 6 of the 12 suction traps, their numbers are not significant. Some of them probably escaped our investigation because they were removed by other colleagues for study.

Absent from the more northern traps, the species is however normally present in these regions. Although widespread elsewhere in Europe, this species is not found in the UK.

This insect is the vector of disease transmitted to cereals: the Wheat Dwarf Virus, studied in France during the early 1990s, at the time of its maximum attack on wheat in central France. The monogeminivirus is a persistent, non multiplicative virus, 2 strains of which are presently known on wheat and barley. *P. alienus* can live on many cereals, but can survive on some dicotyledons too. This behaviour allows it to stay in or around the field after wheat and barley are harvested, by living on cereal volunteers and regrowth, and for several days on industrial plants like colza, when the ground is bare, during autumnal ploughs (della Giustina, 1993).

3. 5. CONCLUSION

The Auchenorrhyncha migrations sometimes cover long distances. The delphacid *Nilaparvata lugens* Stal, a major rice pest in the Far East, can fly 30 hours and travel a distance of 750 km (Rosenberg & Magor, 1987). A huge invasion of *Balclutha pauxilla* Lindberg was observed in the Ascension Island in the Atlantic Ocean which lies at a point roughly equidistant between Recife (South America) and Luanda (Africa); the specimens were probably coming from Africa and flew for more than 2,000km (Ghauri, 1983). Radar observations in China have shown a flight for 1 hour at 700 m altitude, without wind (Riley et al, 1991). No European Auchenorrhyncha species seems to exhibit such long distance movement. In 1994, in France 2 species *J. pellucida* and *Z. scutellaris* generally, and *L. striatellus* in a limited number of traps (especially Valence), showed that long range displacements could occur during the warmer period of the year. Waloff (1973) indicated that flights decrease with height for *J. pellucida* and *Z. scutellaris*, so it is necessary to have large-scale migration in order to collect many specimens of the same species. Waloff showed 2 flight peaks for *J. pellucida*. The first is in the middle of May and the second at the beginning of August. In France, it was impossible to show the first generation flight, even through yellow traps at ground level in 1976. Only the second generation flight corresponded to the second one in Silwood (Southern England).

Not all winged adults fly or disperse (Waloff, 1973) particularly parasitised insects at least when the parasitoid is well developed inside its host. Although no abdomen was dissected, external sacs protruding from the body of the hosts, characteristic of parasitism due to Dryinidae (Hymenoptera) were seen only twice during our study. But Noda (1986) noted for 98♂ and 122♀ rice planthoppers, 2♂ and 10♀ with Dryinids parasites and one of each sex with one Strepsiptera.

The first European exploration of the aerial plankton seems to have been made by Berland (1935) near Paris, following a short study directed by Coad (1931) in USA. Despite this altitude, it is noteworthy that one Auchenorrhyncha specimen of the grass-associated *Arthaldeus pascuellus* was collected in that study, at between 1,000 - 1,200m. Ribaut (cited by Berland), was surprised to identify this species for he thought better fliers like Typhlocybinae living on trees would be more common. In our study, *Z. scutellaris*, the most common leafhopper collected, is a grass-feeder Typhlocybinae. But caught at 12.3m, there is any comparison with insects collected in altitude (more than 1,000m). The 2 other common species, *J. pellucida* and *L. striatellus*, are also grass-dwellers. Among all the species collected, 61% of them live on trees and shrubs, the rest on grasses.

Hypotheses can be proposed to explain such a difference in the numbers of aphids and Auchenorrhyncha collected.

1). The population density is greater for those aphids with larger outbreaks than for Auchenorrhyncha. At Silwood, the density of adult individuals (in a grassland habitat) rarely exceeds 100-200 per m^2 (Waloff, 1979), far less than the density for aphids. Auchenorrhyncha represent no more than 0.9% of the total of flying insects, compared to Aphidoidea which represent 32%, but the effect of the height of trapping is important for aphids too and varies with the species (Hullé et al, 1993).

2). Auchenorrhyncha have a greater ability to disperse a short distance by jumping which is not aphid behaviour.

3). The presence of a significant proportion of brachypters (or sub-macropters) in many species unable to fly.

4). A proportion of non-flying long-wing morphs.

5). The location of the suction trap in the field is more important for Auchenorrhyncha than for aphids.

Using data obtained during this study, we can say that in France, if Auchenorrhyncha species migrate at all, it is mainly for short distances. Long distance dispersal is an exception.

The Agraphid network is of a great importance for Agriculture by studying aphid populations of economic importance. After the results obtained in 1994, if a native Auchenorrhyncha becomes a new pest, as happened with *P. alienus* at the end of the 1980s, it seems that the use of these suction traps will give poor information on its biology, population ecology and population importance. It would be impossible to determine the exact periods of presence or absence of adults in the area studied, to give the date of the first flights and to make a good evaluation of the population fluctuations. Very few species appear to fly at such a height, even during an outbreak. The traps at a lower height must be more efficient in giving a correct idea of the total ground population density as was shown with *Delphacodes kuscheli* Fennah, the vector of maize rough dwarf virus in Argentina (Grilli & Gorla, 1997). In this study, sticky traps with yellow films were located at 6m and 1.5m above the ground. The number of specimens collected at 6m was 1.55 times higher than at 1.5m.

It is noteworthy that the introduced species *Scaphoideus titanus* Ball, the vector of flavescens dorée on grape, now widespread in the southern half of France, was never collected by the suction traps.

To improve our knowledge on Auchenorrhyncha distribution in France, several traps might be moved to other sites, but yellow traps at different heights (cheaper and more mobile) are more efficient for such studies.

Since 1978, the Agraphid network has increased our knowledge of French fauna. Ten new Aphid species have been found for France, 4 being new for Europe (Hullé et al, 1996). In the one year (1994) under study, no new Auchenorrhyncha was collected for France. Nevertheless we obtained some new information on distribution. Besides information on distribution discussed in this text, several other species have increased their distribution in France: *Macropsis graminea, Arboridia velata, Eurhadina ribauti, Eupteryx decemnotata, Liguropia juniperi, Aconurella prolixa, Anoplotettix* *fuscovenosus, Cicadula placida*. But the collection of one specimen at a height of 12.3m is not proof that the species is living around that site, only "gone with the wind".

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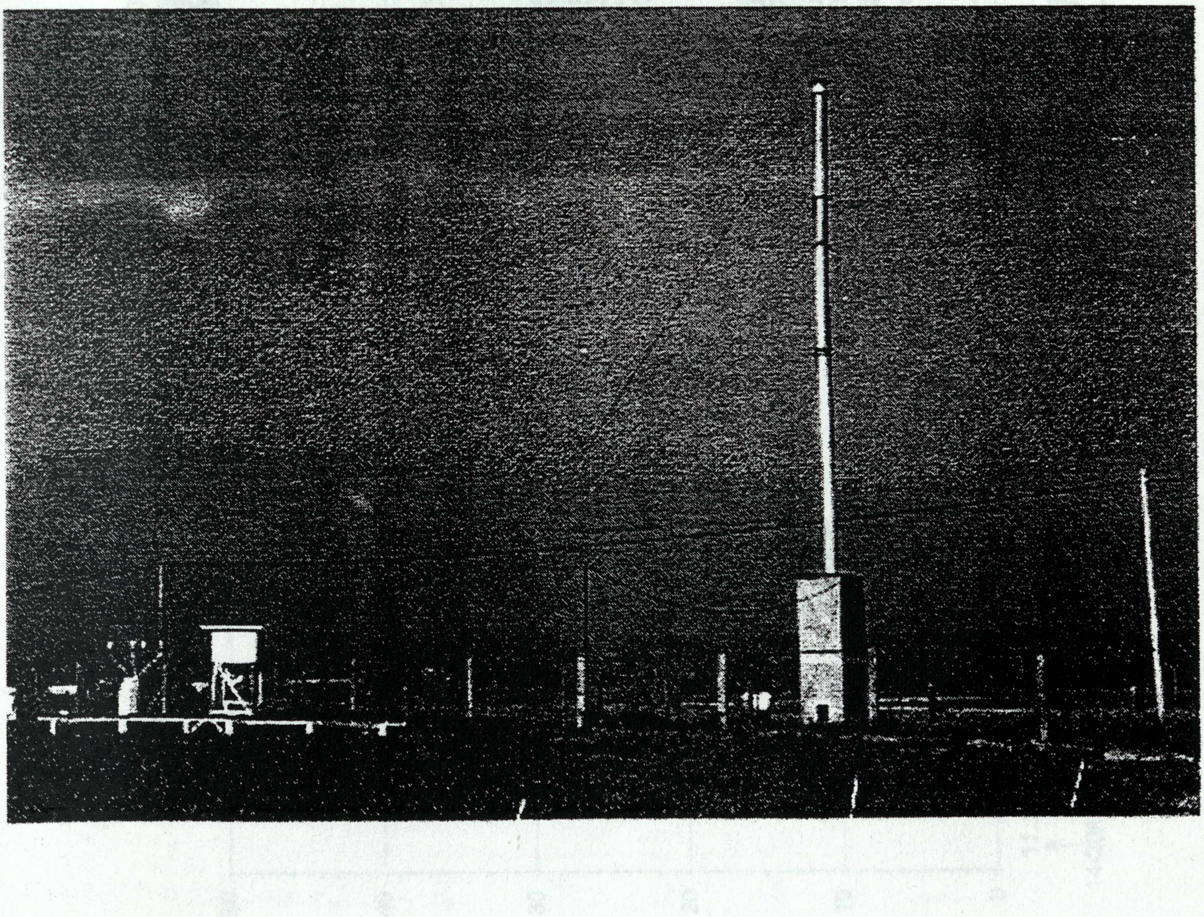


Fig. 1. - The suction trap in Rennes (meteorological station , on left).

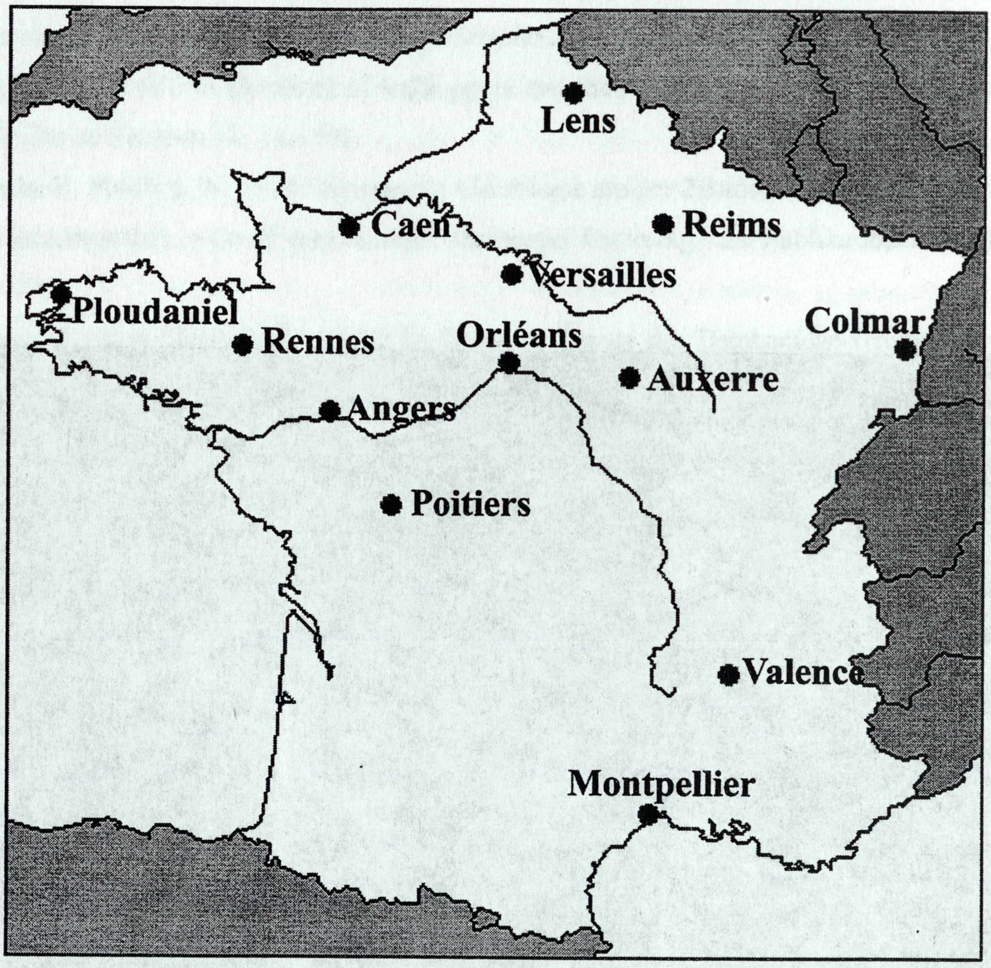
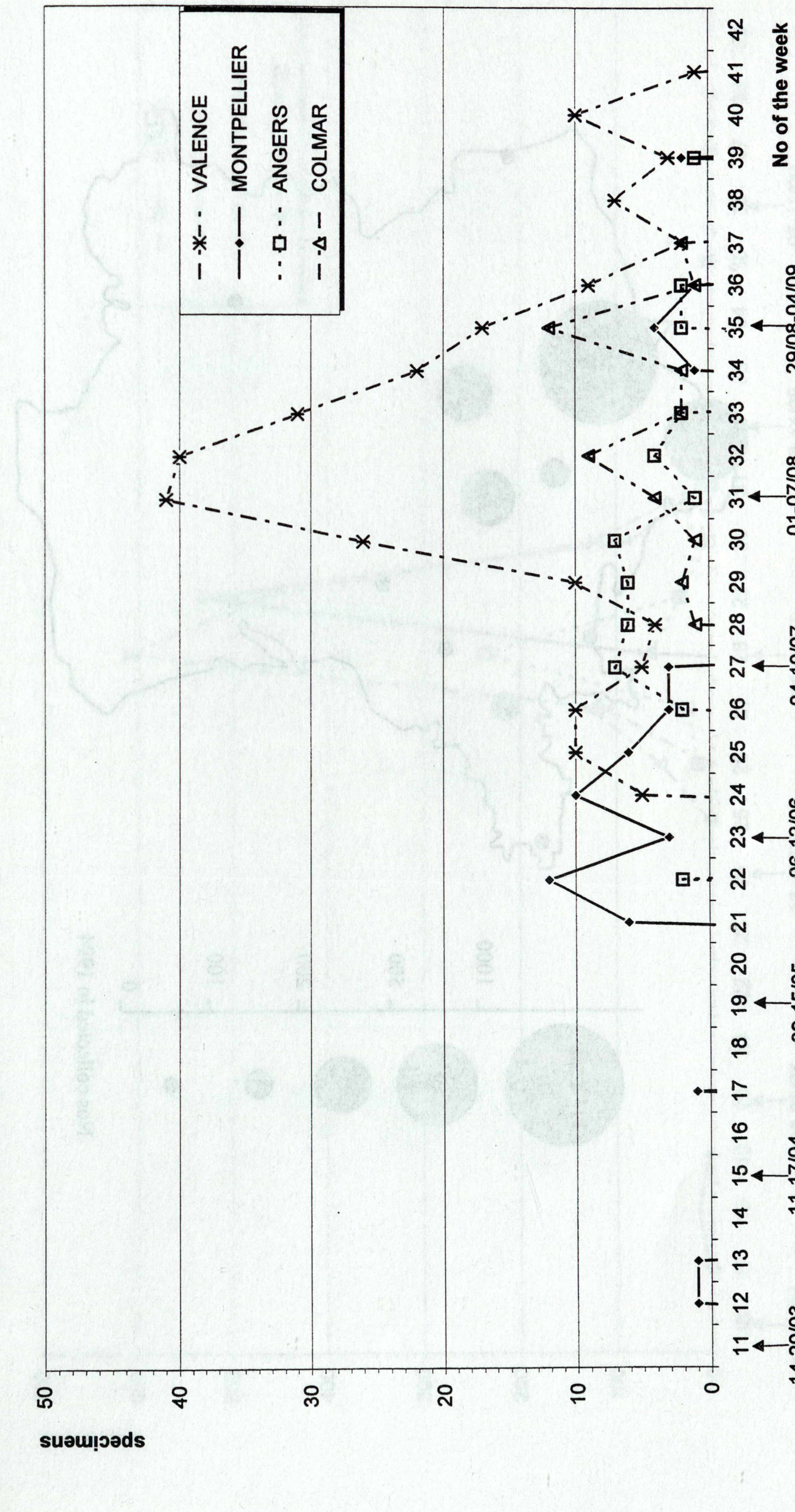


Fig. 2. - Geographic distribution of the 13 suction traps in France (Ploudaniel was studied only for Delphacidae).

Fig. 3. - Population fluctuations of *L. striatellus* from the 4 most important traps for this species in 1994



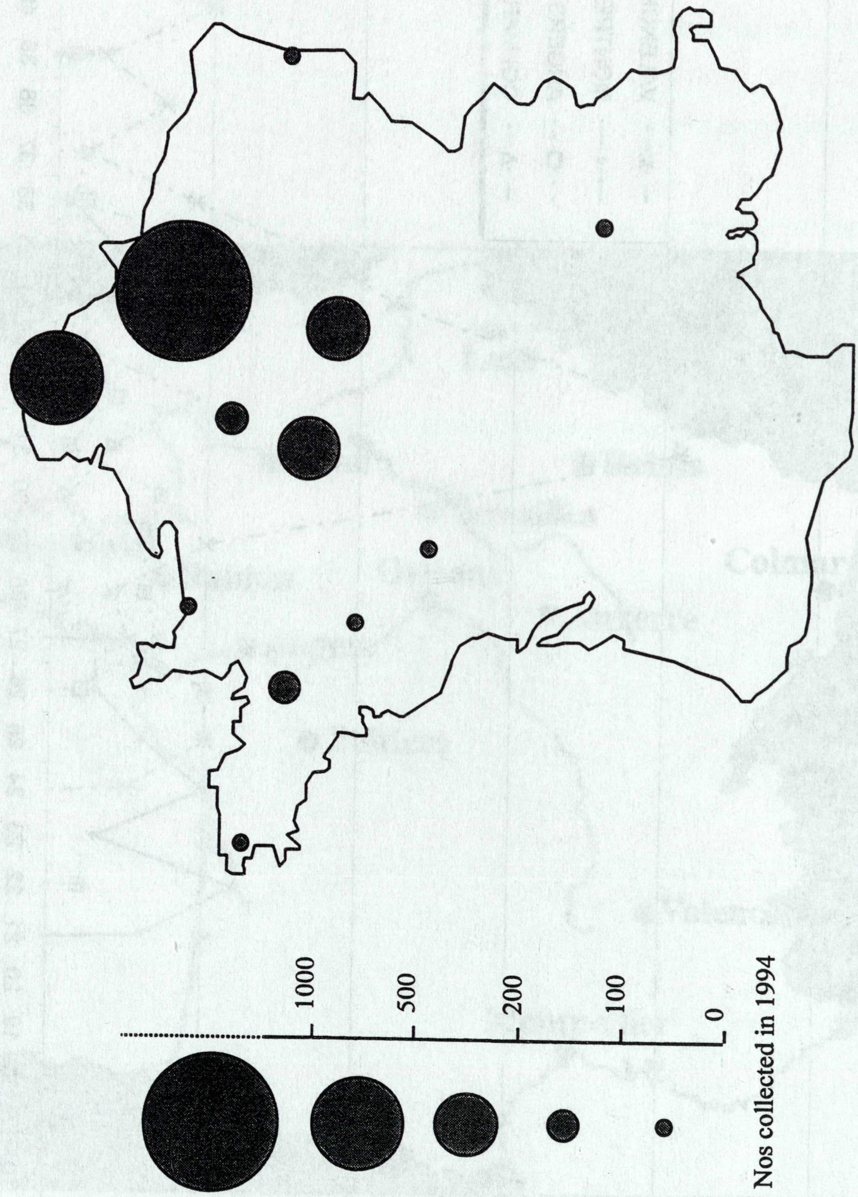
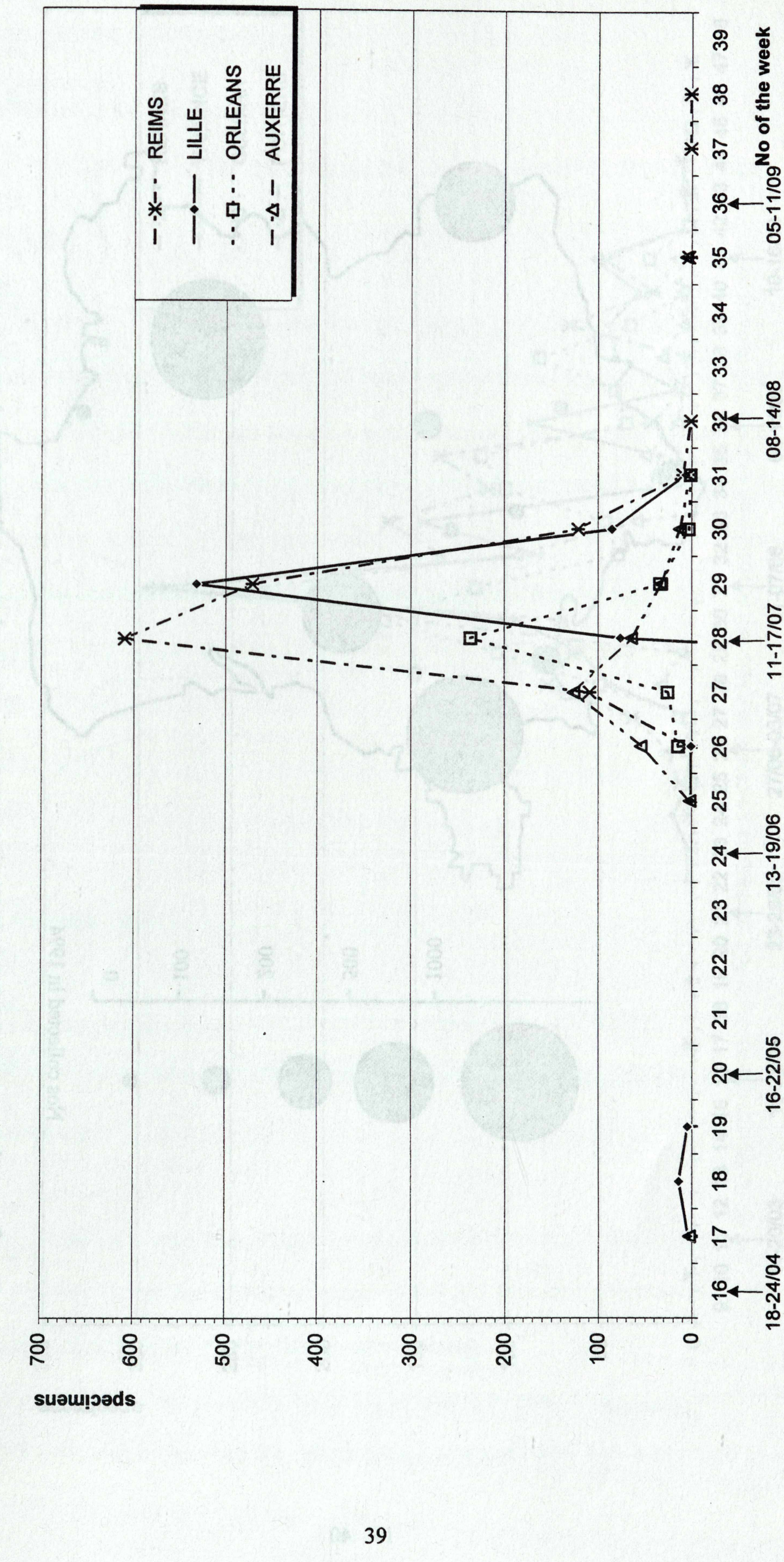


Fig. 4. - Comparative size of the *J. pellucida* catches by the suction trap network in 1994

Fig. 5. - Population fluctuations of *J. pellucida* from the 4 most important traps for this species in 1994



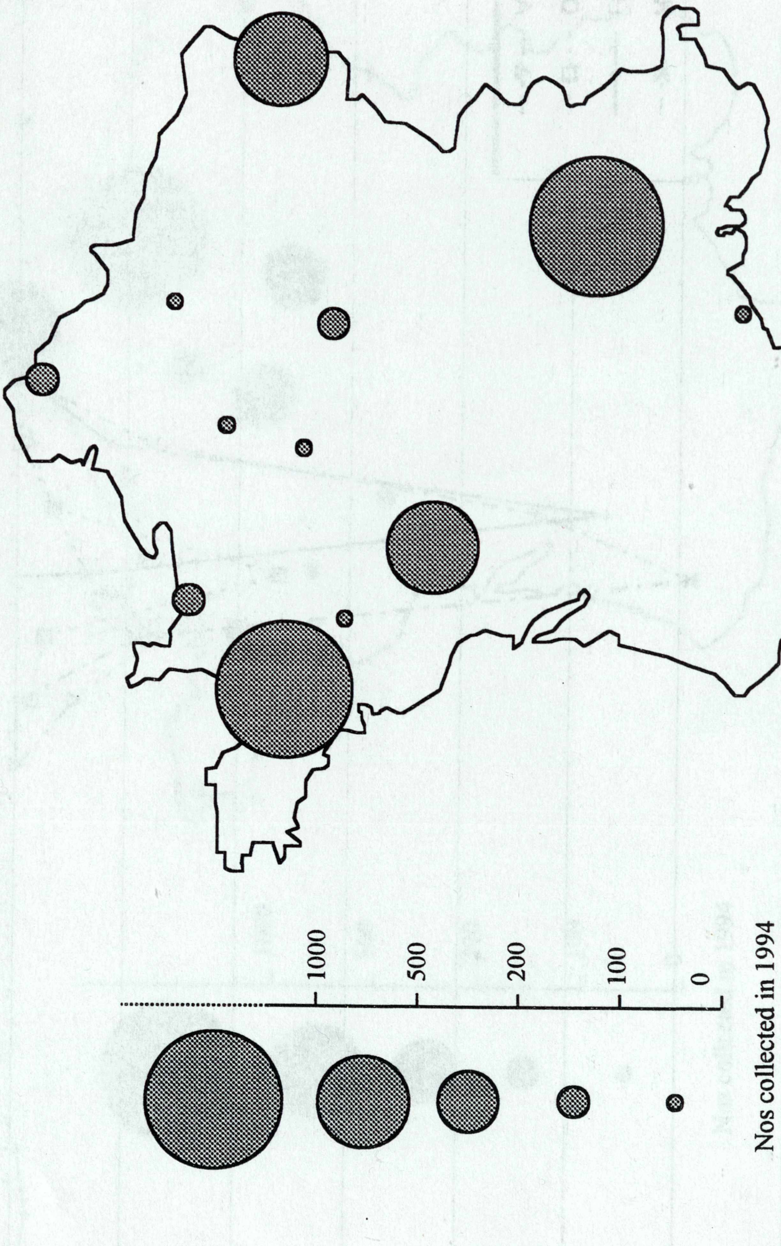


Fig. 6. - Comparative size of the Z. *scutellaris* catches by the suction traps network in 1994

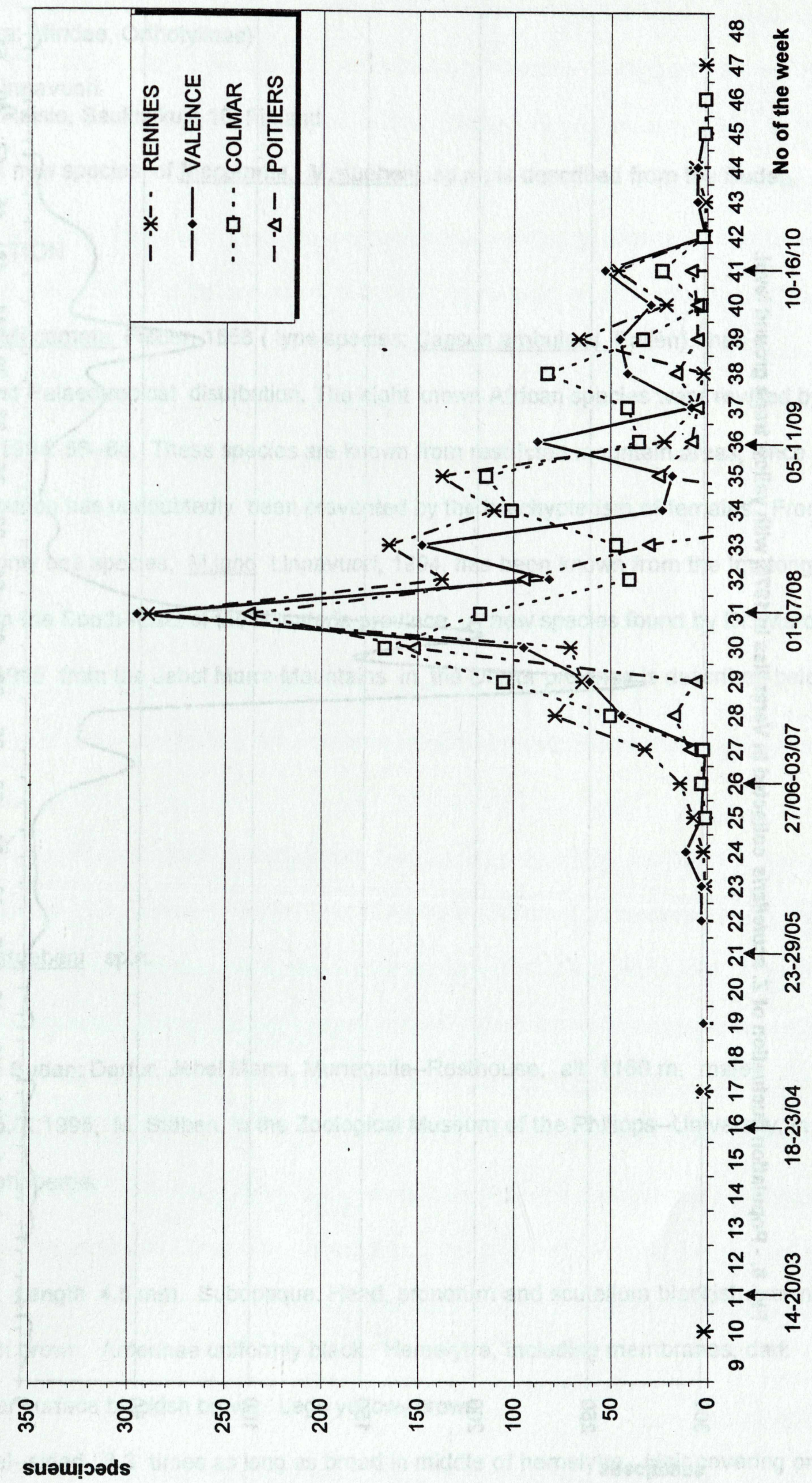


Fig. 7. - Population fluctuations of *Z scutellaris* from the 4 most important traps for this species in 1994

Fig. 8. - Population fluctuation of *Z. scutellaris* collected in Versailles in 1976, with yellow traps ground level.